

High Resolution Regional Reanalysis for Europe and Germany

Jan D. Keller

German Meteorological Service (DWD), Offenbach, Germany

Christian Ohlwein, Christoph Wosnitza, Petra Friederichs, Andreas Hense

University of Bonn, Germany

Within the recently founded Hans-Ertel-Centre for Weather Research, a regional reanalysis group was implemented to concentrate efforts on the assessment and analysis of regional climate in Germany and Central Europe. In this context our group does not only focus on generating regional reanalysis data in high spatial resolution but on developing new statistical methods for the exploitation of observation data.

The first part of the project deals with the generation of state-of-the-art regional reanalysis data sets for Germany and Central Europe and their evaluation. This reanalysis will provide a quality-controlled and homogenized data set as a basis for (1) the detection and assessment of regional climate change in the past and future, (2) the statistical post-processing of operational forecasts, (3) the analysis of systematic model errors of the respective regional model, and (4) the verification and calibration of impact models like e.g. hydrological models.

The regional reanalysis is generated based on the existing data assimilation and weather forecasting system of the German Meteorological Service (DWD). The main model in this system is the DWD's meso-scale numerical weather prediction model COSMO which is for the two nesting steps in the model chain. The first nesting step is represented by COSMO-EU which covers the whole European continent at a resolution of 7 km. In a second nesting step, the horizontal resolution is increased to 2.8 km with a domain covering Germany (COSMO-DE). For our reanalysis, global input data for the nesting is replaced by ERA-INTERIM or 20CR/ACRE data.

The regional reanalysis itself will be separated into two different versions. These will focus on (a) the comparably short time frame of 5 years (2007-2011) with the maximum amount of observation data and nested into ERA-INTERIM, and (b) on the past 30 years (1983-2012) with a reduced data basis, in order to aim at more homogeneous time series than typically available in long-term reanalyses and nested into 20CR/ACRE.

For the short-term reanalysis, this approach comprises the assimilation of observational data using the existing nudging scheme of the DWD for COSMO-DE and COSMO-EU at a frozen model version. The reanalysis scheme for Europe (COSMO-EU) is complemented by a special soil moisture analysis (SMA) and boundary conditions given by ERA-interim data. In the German domain reanalyses (COSMO-DE) a radar latent heat nudging for assimilating precipitation observations will be employed.

The data basis is enhanced with respect to operational use during the period 2007-2011, including radar data. The results of the short term regional reanalysis are verified and quality controlled via ceilometer, GPS, and satellite data. Forward operators are developed that provide pseudo-observations from model output fields for verification in the space of observations and to prepare for future data assimilation.

The long-term reanalysis is planned as an ensemble reanalysis system based on the Data Assimilation Research Testbed (DART) developed at NCAR combined with the COSMO model. In this reanalysis project, data assimilation input is complemented by station data of temperature and precipitation as well as satellite observations. To that end, precipitation fields and respective uncertainty estimates for the assimilation via latent heat nudging are regenerated by spatiotemporal disaggregation of station and satellite data. The boundary 20CR/ACRE projects prepared sufficiently long global reanalysis data, which serve as external ensemble boundary conditions.

To ensure availability and organized distribution, the reanalysis data will be stored and administrated by the Climate Data Center (CDC) at DWD.

Corresponding Author:

Name: Jan D. Keller
Organization: German Meteorological Service (DWD)
Address: Deutscher Wetterdienst
Frankfurter Str. 135
63067 Offenbach
Germany